II. **Solution by L. C. WALKER, A. M., Graduate Student, Leland Stanford Jr. University, Cal.**

The equation may be written

$$\left[\frac{d}{dt}-m\left(\frac{d}{dx}\right)^2\right]u=0;\text{ from which }u=\left(\frac{d}{dt}-m\frac{d^2}{dx^2}\right)^{-1}0.$$

By integrating with respect to t, we get

$$u=e^{mt(d^2/dx^2)}\phi(x)=\phi(x)+mt\frac{d^2\phi(x)}{dx^2}+\frac{m^2t^2}{1.2}\frac{d^4\phi(x)}{dx^4}+\ldots\text{ etc.}$$

By integrating with respect to x we shall have two arbitrary functions of t, since the differential with respect to x is of the second order. Now writing the equation in the form

$$\left[\frac{d}{dx}-\frac{1}{m^{\frac{1}{2}}}\left(\frac{d}{dt}\right)^{\frac{1}{2}}\right]\left[\frac{d}{dx}+\frac{1}{m^{\frac{1}{2}}}\left(\frac{d}{dt}\right)^{\frac{1}{2}}\right]u=0,$$

we obtain $u=e^{\sqrt{[(1/m)(d/dt)]}x}\phi(t)+\varepsilon^{-\sqrt{[(1/m)(d/dt)]}x}\psi(t)$

$$=F(t)+\frac{1}{m}\frac{x^2}{1.2.3}\frac{dF(t)}{dt}+\frac{1}{m^2}\frac{x^4}{1.2.3.4}\frac{d^2F(t)}{dt^2}+\ldots\text{ etc.}$$

$$+xf(t)+\frac{1}{m}\frac{x^3}{1.2.3}\frac{df(t)}{dt}+\frac{1}{m^2}\frac{x^5}{1.2.3.4.5}\frac{d^2f(t)}{dt^2}+\ldots\text{ etc.},$$

where $\phi(t)+\psi(t)=F(t)$, and $(d/dt)^{\frac{1}{2}}[\phi(t)-\psi(t)]=f(t)$.

This is the equation for determining the linear transformation of *heat* in an infinite solid.

Also solved by *G. B. M. ZERR*, and *M. E. GRABER*.

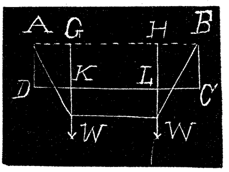
MECHANICS.

149. **Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.**

From two points in the same horizontal line hangs a light inextensible string, on which are threaded two beads of equal mass. The beads start from rest in the position in which the terminal portions of the string are vertical and move symmetrically towards each other in the vertical plane. Find the path of each bead, and the tension of the string at any point in the path.

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

Let A, B be the points from which the weightless string hangs; D, C the position of the beads when the string is stretched and the beads are on the point of starting so that AD, BC are vertical; let the mid-point of KL be the origin; E, F the position of the beads at any time; $2a$=length of string; $2b=AB$; $W=$



weight of each bead; (x, y) the coördinates of F. Then we have $\sqrt{(HB^2+HF^2)}+\frac{1}{2}EF=a$.

$\therefore \sqrt{[(b-x)^2+(a-b+y)^2]}+x=a$,

or $y^2+2(a-b)y+2(a-b)x=2b(a-b)$,

or $(y+a-b)^2+2(a-b)x=(a-b)(a+b)=a^2-b^2$.

$\therefore (y+a-b)^2=(a-b)(a+b-2x)$, this is the locus of the bead F. $\therefore$ Each bead describes the arc of a parabola. Let T=tension of the string at any point, $\theta=\angle HFB$; resolving vertically, $\frac{1}{2}T\cos\theta=W$, or $T=2W/\cos\theta$. Now $1/\cos\theta=BF/HF=\sqrt{[(b-x)^2+(a-b+y)^2]}/(a-b+y)$.

$\therefore 1/\cos\theta=(a-x)/(a-b+y)$. $\therefore T=2W(a-x)/(a-b+y)$.

When $x=b$, $y=0$, and $T=2W$.

$\therefore x=0$, $y=\sqrt{(a^2-b^2)}-(a-b)$, $T=2aW/\sqrt{(a^2-b^2)}$.

DIOPHANTINE ANALYSIS.

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104. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, Ohio.

(1). The cube root of three cube numbers equals the square root of two square numbers. Determine the numbers.

(2). The sum of the square roots of three square numbers equals the sum of the cube roots of three cube numbers. Determine the numbers.

Solution by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

If we assume the three cube numbers to be x^3, y^3, and z^3, and the two square numbers to be u^2 and v^2, we are to find values of x, y, z, u, and v so that the equation $x+y+z=u+v$ shall be satisfied. Any four of these values may be selected at pleasure and the fifth one may then be determined. For example, let $z=1$, $y=2$, $u=3$, $v=4$. Then $x=4$. The cube numbers are 64, 8, 1, and the two square numbers are 9 and 16. By assuming any values whatever for y and z, and any values of u and v such that their sum is greater than the sum of y and z, as many positive numbers may be found satisfying the conditions of the problem as may be desired. The second part of the problem may be solved in the same way.

105. Proposed by HARRY S. VANDIVER, Bala, Pa.

Every odd factor of a^n+b^n is of the form $1(\text{mod} 2n)$.

No solution of this problem has been received.

106. Proposed by L. C. WALKER, A. M., Graduate Student. Leland Stanford Jr. University, Cal.

There is a series of rational triangles whose sides have a common difference of unity. Calling the one whose sides are 3, 4, 5 the first triangle, find the sides of the next five triangles, and a general expression for the sides of the nth triangle.